



Vaccine containing immunologic adjuvants with a wide range of activity to provide protection against COVID-19

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Abstract

This paper proposes a wide spectrum immunologic adjuvant for vaccine development against COVID-19 which is the current global problem. It has been reported that a wide range of immune cells are involved in the body's response to SARS CoV2 infection. Therefore, vaccine with a wide-spectrum immunologic adjuvant can be used to provide protection against COVID-19. Lack of adjuvants that can induce the required immune responses is a serious impediment to vaccine development against this devastating virus. The approved adjuvants such as aluminum salts and MF59 exhibit a narrow range of activity. In an attempt to solve this problem, it is crucial to develop new adjuvants which can trigger a wide range of immune cells.

Keywords: Adjuvant, COVID-19 vaccine, Vaccine with a wide-spectrum immunologic adjuvant

1. Introduction

COVID-19 is a devastating viral disease which can be prevented by vaccination. Vaccine has played a critical role in protecting the global community from various infectious diseases. Vaccine development against COVID-19 is hindered by lack of approved adjuvants that can induce the desired immune responses. The approved adjuvants such as aluminum salts and MF59 exhibit a narrow range of activity. To circumvent this problem, it is crucial to develop a wide spectrum immunologic adjuvant that can be used in vaccine against COVID-19.

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Discovery of new adjuvants with a wide range of activity is necessary to develop an effective vaccine against the novel corona virus. Immunologic adjuvants are key to develop an effective vaccine against infectious diseases in human and non-human primates. Adjuvants are immunostimulatory molecules that enhances immune response to vaccine antigens. Immunologic adjuvants are co-administered with a specific antigen to trigger rapid and robust humoral and cellular immune responses. Using antigen in combination with adjuvant offers significant advantage over using antigen alone because adjuvant improve immunogenicity of antigen.

Comprehensive understanding of immune mechanisms needed for protection against infectious diseases played a critical role in developing many vaccines that we are using today. Thus, in-depth understanding of immune mechanisms required for protection against COVID-19 can help us to use better adjuvants for vaccine development against COVID-19. It has been proved that a wide range of immune cells are involved in the body's response to SARS CoV2 infection. Adjuvants with ability to induce immune cells which are involved in SARS CoV2 infection are needed to develop an effective vaccine against COVID-19.

Vaccines containing an appropriate adjuvant are important for the prevention of various infectious diseases which are the biggest threats to human and animal health. It is crucial to use adjuvants with minimal side effects and high potency so as to develop safe and efficacious vaccines. Potent adjuvants with undesirable effects are not recommended to be used in vaccine development.

2. Vaccine adjuvants

Adjuvant is a term coined from the Latin word *adjuvare*, which means to help or to augment. Immunological adjuvants are agents that enhance specific immune responses to vaccines [15]. Aluminum hydroxide typically referred as “alum” and other aluminum salts are the most widely used adjuvants in human and animal vaccines [7]. Although vaccine adjuvants have been used for almost a century, alum is the only adjuvant licensed by the US FDA for human vaccine use [11].

Adjuvants are chemicals, proteins or derivatives of microbial formulated with vaccines to enhance innate and adaptive immune response to vaccine antigens by a variety of mechanisms [6]. There are several types of adjuvants with differing modes of action. These include mineral salts, oil emulsions, immune stimulating complexes (ISCOM), bacterial derivatives,

carbohydrate adjuvants, liposomes, cytokines, virus like particles and polymeric microparticle adjuvants [12]. Nonreplicating, purified subunit or synthetic viral vaccines of the future are likely to be weak immunogens that will require immunopotentialization if they are to be effective. These marginal vaccines could be improved by combination with potent and safe immunologic adjuvants [5].

The success of adjuvants in enhancing the immune response to recombinant antigens has led many researchers to re-focus their vaccine development programs [9]. Adjuvanted vaccines afford invaluable protection against disease, and the molecular and cellular changes they induce offer direct insight into human immunobiology [14].

3. Developing a novel immunologic adjuvant for use in vaccine against COVID-19

The development of novel immune adjuvants is emerging as a significant area of vaccine delivery based on the continued necessity to amplify immune responses to a wide array of new antigens that are poorly immunogenic [8]. Over the past 10–15 years, a large research effort has attempted to find novel adjuvants with ability to induce a broad range of immune responses, including cell-mediated immunity [13]. Recent advance in vaccine adjuvants is timely, given the need to create novel vaccines to deal with the COVID-19 pandemic [3].

Discovering new adjuvant that are essential components of vaccine formulations helps the development of more potent vaccine, which induce strong immune response. [6]. Vaccines containing novel adjuvant formulations are increasingly reaching advanced development and licensing stages, providing new tools to fill previously unmet clinical needs [10].

Development of new vaccine adjuvants has entered a golden age of research and development [4]. Despite the impressive success of currently approved adjuvants for generating immunity to viral and bacterial infections, there remains a need for improved adjuvants that enhance protective antibody responses, especially in populations that respond poorly to current vaccines [1]. Currently, many new vaccines are under development and there is a desire to simplify vaccination schedules both by increasing the number of components per vaccine and decreasing the number of doses required for a vaccine course. New, more effective adjuvants will be required to achieve this [2].

4. Conclusions

Vaccine containing an appropriate adjuvant is important to control challenging pathogens that can cause global pandemics. Vaccine with a wide spectrum immunologic adjuvant can be used

to provide protection against the novel Corona virus. Therefore, it is crucial to develop novel adjuvants with a wide range of activity.

Conflict of Interest

The author declares that there is no conflict of interest.

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